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ABSTRACT

This study was a secondary analysis of data collected by staff of the Program for Complex Instruction (PCI). The purpose of the larger study was to investigate the effect on learning gains of having students know the content and performance standards on which they will be judged as well as the effect of using evaluation criteria. This study looks at the 39 student groups, a total of 163 sixth graders, involved in the PCI study. The focus was on whether group performance is a valid measure of academic performance at the group level. The groups were heterogeneously composed on the bases of gender, ethnicity, and academic achievement, and they remained stable throughout the course of the focal unit. Groups completed 5 instructional activities in 5 days. All of the teachers were skilled Complex Instruction teachers who had worked with PCI in the past. Regression analysis and correlational findings show that group performance scores are a valid measure of academic performance at the group level. Data show that the group measure is as fair a measure of academic performance as aggregating individual performance. The evidence confirms that group level analysis can be done successfully for conceptual academic concept. Attachments contain scoring rubrics and activity sheets for two group activities. (SLD)

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Assessing Complex Academic Performance at the Group Level

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Problem

Can we reliably learn about students' academic mastery when measuring performance at the group level? The educational literature is largely silent on this question. One area where the assessment literature is increasingly clear is on the necessity of matching assessment methods with the classroom context (Sheppard, 2000; Stiggins, 2001). But what about when that context includes group activities? Most authors do not consider the possibility that classroom assessment might include anything other than individual performance (cf. Cohen, 1997). Evan as part of a larger work on learning as part of social interaction, researchers can maintain an individual focus when it comes to assessment (cf. Newman, Griffin, and Cole, 1989). To date, group measures are made by aggregating performance on individual measures. This paper examines assessing *group* level academic performance.

Two different questions arise form the attempt to assess academic performance at the group level: "How would you do it?" and "Why not just aggregate individual scores?"

Stated more formally, the first question can be asked: How can one make a valid measure of academic content knowledge of a group? I argue that three features are necessary: the assessment must be specific to the academic content of the activity, the assessment criteria must reflect the intrinsic characteristics of the medium called for (e.g., poster, skit), and consistent judgments are necessary to assure equitable assessments.

Developing this measure had many complexities. Deciding on a method to evaluate group performance was the first necessary step. Rubrics break a whole performance into its constituent parts and explicitly state expectations for the listed levels of performance. This type of scoring system offered the greatest flexibility in organizing this measure and so is used to judge group academic performance. The *type* of rubric used as an assessment tool, the *content* to be assessed, and the *medium* through which that content is to be expressed are all factors to be considered in developing this assessment.

Rubrics for the assessment of group work tend to focus on procedure rather than content (see Solomon 1998 for an excellent overview; Webb, 1995). A literature search turned up no rubrics centered on features of the academic content of the group product. Rubrics generally quantify the amount of work on a group product or the contributions of individual group members as a proportion of the whole. For example, a rubric might measures the amount of history (math, science) that a group accomplishes without examining the historical (mathematical, scientific) qualities of the work.

For each of the five activities in this unit, I designed a rubric to evaluate the group's work *using the historical content specific to that activity*. Each activity in the unit made use of a different medium for the academic performance; these media fell into two categories, production and performance. Balancing type, content, and medium is an intricate operation for which I found little guidance.

In part, the preceding discussion answers my second question: Why not just aggregate individual scores? Individual scores are not feasible for group products that are intrinsically not individual endeavors, such as a skit. Perhaps the question is better stated: How do group performance and aggregated individual performance compare as indicators of academic productivity at the group level? To answer that question I explore three measures of academic accomplishment: group product/presentation, individual essay test performance, and individual multiple-choice test performance, the latter two aggregated to the group level.

Methodology

Design

This study is a secondary analysis of data collected by staff of the Program for Complex Instruction (PCI). Their purpose was to investigate the effect on learning gains of having students know the content and performance standards on which they will be judged as well as the effect of using evaluation criteria

(Abram et al 2000). The PCI design, using Campbell and Stanley's (1963) terminology, was a quasi-experimental non-equivalent control group design.

This study looks at the 39 student groups involved in the PCI study. The groups were heterogeneously composed on the bases of gender, ethnicity and academic achievement and remained stable throughout the course of the focal unit. Groups completed five different activities in five continuous days, though in varying order. Data were scored for the first, third, and fifth days of the unit. Various groups were recorded doing the full range of tasks on each day scored. Audio tapes of group presentations, photos of the groups in action, and group products were used to generate the group performance scores. Group performance was scored by the author and one other scorer. Agreement was established separately for rubrics on each of the 5 activities. Scorers reached greater than 90% agreement on all of the rubrics.

Setting and Sample

Thirty-nine student groups from five sixth-grade classes (N=163), drawn from a multiracial, multiethnic, and largely poor sector of California's Central Valley, participated in the study during the 1998-1999 school year. The average national percentile ranking on the SAT-9 standardized reading test for students in the sample was 34.6. Approximately 25% of students in the study were designated limited English proficient. Many students reported either Spanish or Punjabi as their first language. As is common in many of the communities in California's Central Valley, many local residents are immigrants or migrant agricultural workers.

In each of the five classrooms, students completed the same four instructional units based on the Complex Instruction (CI) model of cooperative learning (cf. Cohen and Lotan, 1997b). Three classes implemented Complex Instruction units with evaluation criteria and two classes implemented identical units except for the absence of evaluation criteria. All students enrolled in the

participating teachers' classrooms were studied. In all cases, the unit was part of the teacher's regular curriculum. Students practiced group skills using "skillbuilder" exercises prior to the implementation of the units. These skillbuilders provided students with guidelines and practice on how to hold academic discussions. In classrooms using the evaluation criteria, the skillbuilder focused on talk using the evaluation criteria. In the comparison classrooms, the skillbuilder was designed to improve the skills necessary for high-quality group discussion.

All classes completed three preliminary Complex Instruction units to acquaint students with group activities, roles, and norms, and to familiarize the teachers and students with data collection procedures and instruments. Data used in this study were collected during the fourth and final CI unit, "The Importance of the Afterlife in Ancient Egypt."

Teachers participating in the study were all skilled Complex Instruction teachers who had worked with PCI in the past. Each had completed a 10 week course on Complex Instruction at California State University at Stanislaus in either 1994 or 1995. At the completion of the course, each teacher participated in a year-long follow-up and feedback program at their school site, which included at least nine classroom visits by their CI trainer. All of the teachers have made CI units part of their regular curriculum in each school year since their training. Three of the five teachers returned to CSU Stanislaus for advanced work on training other teachers in CI; four of the five did advanced work on curriculum development.

PCI staff selected participating teachers on the following criteria: 1) effective classroom management skills; 2) solid social studies content knowledge and understanding of the curriculum; and 3) successful prior implementation of Complex Instruction. Teachers participating in this study taught at year-round schools. While units were taught at different points in the calendar year, each unit was taught at approximately the same point in the teacher's academic year.

Rubrics

Before detailing the procedures of rubric development, I outline the assumptions that underlie this work and infuse the rubrics. I maintain that to best evaluate academic performance, three features are necessary. First, the assessment must be specific to the academic content of the activity. Second, the assessment criteria must reflect the intrinsic characteristics of the medium called for (e.g., poster, skit). Finally, consistency among rubrics is necessary to assure equitable assessments. Consistency may depend on similar bases for judgment or on ensuring that the magnitude of a given element affects outcomes to a similar degree across rubrics.

Two types of rubrics are used here (Solomon 1998). Developmental rubrics use substantive differences in product quality as the distinction between levels. Task-specific rubrics measure the magnitude of a given characteristic (none, few, some, lots).

Curricula

In addition to selecting an evaluation tool, another complexity in assessing group performance is the organization of the curriculum. Complex instruction (CI) curricula, organized around "big ideas" central to the discipline, include both specific factual content and broad conceptual content. CI units also include a performance component requiring groups to display their command of the academic content. A summary of the unit, "The Importance of the Afterlife in Ancient Egypt," is given in Table 1. The table shows the concrete and conceptual academic content and the performance component for each of the activities in the unit. These activities require groups to embed the concrete academic content within a specific context. The "facts" are applied while exploring conceptual content. The performance component of this curriculum requires that groups make or do something using the academic information. Further, the task often requires groups to make a presentation to the class, explaining to others what they have done.

Before describing the methods used to assess groups, let me define terms used in this discussion. "Concrete content" is the term I use to describe academic content that has a simple right/wrong aspect. Facts are concrete content as are simple concepts such as "a pharaoh is like a king". "The Importance of the Afterlife in Ancient Egypt" included concrete content such as the organization of a typical tomb (Activity 3) or the steps in the mummification process (Activity 4).

"Conceptual content" is used to refer to academic concepts in the unit. Concepts can be defined as a combination of ideas that reveal general classes of things, behaviors, organizational patterns, etc. Concepts can sound simple (e.g., tombs were considered houses for the afterlife) and yet carry large numbers of implications and assumptions with them (e.g., houses assume a lifestyle bringing issues of décor, servants, comfortable furniture, etc.). As its name suggests, the unit studied focused on the concept of how ideas about the afterlife affected the way ancient Egyptians lived their everyday lives. Each activity featured one aspect of that very broad concept. For example, in Activity 4, groups explore how the preservation of the body through mummification allowed the deceased to "live" in the afterlife, as he or she lived before death.

Breaking down the historical content of the unit in another way, the various activities are different representations of the same overarching concept. Eisner (1994) argues that multiple representations of the same concept, using a variety of media, opens generally untapped avenues of access to the academic content for students. The tasks in this unit were specifically designed to tie the medium of a task to the content featured in that activity. For example, in Activity 3, groups learn about tomb design by designing a tomb. In addition to allowing uncommon access to students, each activity is designed to require a variety of intellectual abilities. This expanded range of intellectual abilities gives more students access to the curriculum (Lotan, 1997a). Lotan maintains that making a concrete product that is closely tied to academic content can be useful to enhancing academic writing (Personal communication, November 2000).

Figure 1: Elements in group performance, components to be assessed, and rubric type used for that assessment

Group Performance		
Product	Presentation	*Rubric Type*
• concrete content	• concrete content	*Developmental*
• conceptual content	• conceptual content	*Developmental*
• presentation conventions	• presentation conventions	*Task-specific*

Figure 1 shows the different elements of group performance in CI curricula, the performance components to be assessed, and the type of rubric used to assess those elements in the current work. Different types of rubrics are suited to different components of academic performance. In evaluating groups' work, it is necessary to match the assessment to the form of expression called for. It is also important to address the given context in assessing academic content. Further, it is necessary to assess the use and sophistication of certain conventions of presentation. I chose rubrics that best match the purpose of the assessment. I found that two distinct types of rubrics mentioned above, developmental and task-specific rubrics, were best suited for this task.

The unit "The Importance of the Afterlife in Ancient Egypt" includes five different activities, each centered on a specific aspect of the unit's big idea. Each of the five activities has three components (concrete content, conceptual content, and presentation conventions) to be judged for two separate elements (product and presentation). Separate rubrics were developed for each of these parts, making a total of 30 rubrics.

Table 1: Performance Summary for Group Activities in "The Importance of the Afterlife in Ancient Egypt"

	Task	Concrete Content	Conceptual Content	Product
Activity 1: Who Says You Can't Take It With You	Produce a tomb painting depicting the afterlife and including items essential to a happy afterlife	Implements of daily life in ancient Egypt	Representations reflect reality and affect living in afterlife	Tomb painting
Activity 2: Heavy Heart	Develop and perform a skit showing the journey to the afterlife and the weighing of the heart ceremony	Actors and roles in weighing of the heart ceremony	Accountability in death affects actions in life	Skit
Activity 3: Tombs – Houses Of Eternity	Acting as tomb designers, prepare a recommendation to the pharaoh for a tomb addressing type and design	Tomb styles or design and methods of construction	Tomb as home affects living in afterlife	Tomb design
Activity 4: I Want My Mummy	Create and perform a song, rap, or dance detailing the mummification process	Procedures for mummification	Afterlife is incarnate; body and nature both present	Song, rap, or dance
Activity 5: Gods And Goddesses	Create a god or goddess for the ancient Egyptian afterlife	Selected pantheon of ancient Egyptian gods and goddesses	Gods' role in afterlife affects people while alive	Design a god or goddess

Unit big idea: The Importance of the Afterlife in Ancient Egypt – Effects of beliefs about afterlife on the living

Assessing Content

Developmental Rubrics

Distinguishing Academic Content. I use Activity 3: "Tombs – Houses of Eternity" and Activity 4: "I Want My Mummy" throughout this section as examples of the elements of evaluation. The first of these activities requires both a product and presentation, the second requires a performance. The activities use different media: a design or model of a tomb versus a song, chant, or dance; they have different content, one featuring tomb design and the other the mummification process. The activities focus on different parts of the big idea–the preparation of a physical home and the idea that the afterlife is incarnate for both body and spirit. Both address the central concepts of the unit: the importance of the afterlife in ancient Egypt, and the effects of beliefs about the afterlife on the living.

As indicated in Table 1, Activity 3, "Tombs – Houses for Eternity," includes as concrete content how tombs were designed and made. The conceptual content is the idea that the tomb serves as a home for the deceased's next life. Groups are asked to make a design or 3-D model of a tomb. Activity 4, "I Want My Mummy," includes as concrete content the stages of the mummification process. Conceptually, groups explore ideas of how the body is used to *live* in the afterlife. As their "product," groups perform a song, rap, or dance.

Rubrics for assessing concrete content explicitly call for groups to include specific facts or ideas. The concrete content rubric for Activity 3 states, "Depiction [is] clearly monument or hidden type of tomb;" the rubric for Activity 4 states, "Song, rap, or dance addresses 5 or more major elements [of the mummification process] giving details of each step."

Rubrics for conceptual content require that the ideas explored be placed in their historical context by stating the expected application of the concepts of the activity. The conceptual content rubric for Activity 3 states "Depiction is consistent with ancient Egyptian tomb design…tomb protects occupant's goods

in a manner consistent with ancient Egyptian tomb design." The rubric for Activity 4 requires that the "Song, rap, or dance makes [a] link between mummification and [a] specific spiritual element."

All rubrics assess content as it is embedded in the specific historical context and as it is applied to the given situation. Each application of the academic content is centered on the big idea of the importance of the afterlife to ancient Egyptians.

Consistency Across Activities. Consistency was mentioned in the previous section as a necessary element for a set of rubrics. I have just outlined the techniques I used in order to ensure consistency or having a similar basis for judgment. I now discuss the steps taken to assure similar increments between scoring levels across the different rubrics.

Table 2: Distinctions among scoring values for content-based, developmental rubrics

Concrete Content	Score	Conceptual Content
Minimal or missing	1	Not present
Applied but with elements missing or wrong	2	Incomplete or inconsistent
Applied with reasoning included	3	Ideas consistent with ancient Egyptian beliefs — but implicit
Applied with included reasoning; complete, coherent, exemplary	4	Ideas consistent with ancient Egyptian beliefs — and explicit

Table 2 shows the distinctions between levels used for concrete content and conceptual content rubrics. Performance extremes were easiest to identify, as they defined the first and fourth categories for the rubrics. In a number of cases, the content of the activity was simply "not there" in the group product or

performance. For example, a group assigned to make a song, rap, or dance for Activity 4 sang the lyrics:

"The king is dead
He died in his bed
Before he was wed."

None of the processes of mummification are present. This example typifies group performance given a score of "1." Compare the song above to the following response to the same assignment. The lyrics below are reprinted exactly as they appear on the students' lyric sheet used in the group performance.

[Sung to the tune of *Queen's* "We Will Rock You"]

(Chorus)

We will we will mummify you
We will we will mummify you

In the beginning will take out your brains your heart and all you orgains all over the place you've got salt on your Face from preserving you and leting you dry out for at least 40 days.

We will we will mummify you
We will we will mummify you

We put pads under your eye's and wax in your nose and rap you with linen for your clothes.

We will we will mummify you
We will we will mummify you

The Ba and Ka will recognize you because of your mask and you will be juged because of your past.

We will We will mummify you
We will we will mummify you

We'll put you in a coffin or maybe 2 or 3 then

we decorate you with all kinds of jewelry

We will we will mummify you
We will we will mummify you
We will we will mummify you

This song thoroughly covers the concrete content of the activity and explicitly ties mummification procedures (the use of a mask) to the needs of the Ba and Ka (to reunite body and spirit). This song is an example of work given a score of "4."

Distinctions between the two middle performance levels were not as clear. Table 2 gives the distinctions that typified the various levels. Moving from one extreme to the other, it became apparent that some groups were earnest in their attempts to do the work, but lacking in mastery of the content. Groups like this might include mummification procedures but get them wrong (e.g. "the mummification process takes 2 weeks"), misunderstand an aspect of the process (e.g., "put him in the coffin and then apply salt"), or leave out large portions of the process (e.g., "take out the organs then put him in the sarcophagus"). Products that did not communicate mastery of the material, but that did show an incomplete command of the material were given a score of "2." Other groups demonstrated a sufficient command of the material but did not have either the sophistication of exemplary work or lacked the understanding that they had completed the assignment. Such groups did the assignment but did not recognize they had done it completely or well. Products that communicated mastery of the material, but had small gaps in their understanding were given a score of "3."

In summary, academic content was categorized as either concrete or conceptual and was scored using developmental rubrics. Distinctions between scoring levels were consistent within a category and as similar as possible across rubrics. The big idea was woven throughout the rubrics echoing the same ideas for all of the activities.

Characteristics of the Medium. A third complexity of scoring group performance is the range of media called for in the unit. Each activity used a different medium; each medium had its own characteristics. I stress the importance of matching assessment criteria to the medium called for in the activity. Another factor to consider in assessing group performance is the consideration that while academic content is contained within the unit, conventions for presenting that information using a given medium are not. Students are supposed to learn about ancient Egypt in the unit.; there is no provision for students to learn songwriting skills. Students may bring skills with the various media to the task or they may develop the skills as the unit progresses and they observe their peers and receive feedback from their teacher. However, development of these skills is not the academic goal of the unit.

Throughout the scoring of group performance, I attempt to minimize the effect of skills in a particular medium on judging content. I acknowledge the importance of the match between the medium and the content expressed as I also recognize the importance of the pre-existing skill sets that students bring to the group task. Such concerns led to the decision to use task-specific rubrics for judging presentation conventions, rather than the developmental rubrics used for the content assessments.

Task-Specific Rubrics

Assessing the various media begged the question "To what extent is this product a good example of what it is supposed to be?" Is this model a good model? Does this song exemplify what a song should be? Two types of criteria emerged in judging presentation conventions. First, I looked for the presence of elements intrinsic to the medium. Second, I looked at the sophistication of the use of those elements.

For example, the design for a tomb intrinsically requires a floor plan, and a setting, among other things. A sophisticated tomb design might include a

mummy in the burial chamber and tomb paintings on the walls. A song about the mummification process can be expected to have rhythm and maybe, rhyme. A sophisticated mummification song might include a chorus or harmony. Rubrics for assessing presentation conventions judged specific elements either as "present or absent" or judged them on a scale of "poor/fair/good."

It should also be noted that some of the conventions for making a presentation to the class are consistent across all activities (e.g., speaking loudly enough to be heard). Rubrics for the different activities included a section on presentation conventions. This rated group performance as "formulaic," "mixed," "adequate," or "fluent" on a range of presentation skills including "Topics presented in an orderly manner; transitions made between topics" (Activity 3) and "Clear separation made between song, rap, or dance and remainder of the presentation" (Activity 4).

Based on my review of the literature, task-specific rubrics are far more common than are developmental rubrics. No doubt this occurs because of the relative ease of generating a relative scale (none, few, some, lots) as compared to the difficulty of specifying group performance with distinct differences based on academic content.

Scoring

Several types of data were used to score group performance. Audio tapes of groups making their presentations were one of the primary sources of data. Group presentations were recorded with a tape recorder placed near the presenting groups. A recording of the teacher was made at the same time. Occasionally, the teacher's tape was used to clarify speech recorded on the group performance tape.

The group product itself was another main source of data. Wherever possible, group products were collected by the research staff. Where the group product could not be stored, at least one, and usually several, photographs

showed the item. Any other data available was used in the scoring where appropriate. For instance, in many cases scripts and props were collected.

Photographs were also taken of the groups, standing before the class, making their presentations. In these photos the scorer was able to see the product displayed and to see the costumes or props as well as the placement of actors.

Group performance was scored by the author and one other staff member. Scoring rubrics were compiled for each activity using the three sections discussed above, concrete content, conceptual content, and presentation conventions. Agreement was separately established for each of the 5 activity rubrics. Scorers reached greater than 90% agreement for all of the rubrics.

Each rubric described performance using a 4-point scale for the categories of concrete content, conceptual content, and presentation conventions. Preliminary analyses indicated a high degree of colinearity among these measures. Measures were indexed for the two aspects of performance: product and presentation, averaging scores to maintain the 4-point scale. Again, the measures were strongly correlated ($r = .80$, $p < .00$). The final group performance measure adds product and presentation scores and averages them across the three rotations, preserving the 4-point scale.

Results

I began by asking how can one make a group performance measure. The previous sections lay out *how* it can be done. I turn to the question of *to what effect* can group performance measures be used.

How do group performance and aggregated individual performance compare as indicators of academic productivity at the group level? To answer that question I explore the three available measures of academic accomplishment: average group performance, individual essay performance (essay), and individual multiple-choice post-test performance (test). Table 3 gives descriptive statistics for the variables. Average group performance is reported as a grand mean of group product and presentation scores (on a scale of 1–4)

averaged for the first, middle, and last days of the unit. Essay performance is reported as the aggregate of group members' individual scores on two aspects of essay writing: factual content and conceptual content.[1] This variable is measured on a scale of 2–8. Post-test performance measures students on the same 30-question, content-referenced, multiple-choice test that was used before instruction began. Scores are reported as the percentage of correct answers. All of the variables reported are normally distributed. On all three measures, the students in this sample "topped out" well below the maximum performance possible.

Table 3: Descriptive statistics for group and aggregated individual performance measures (N = 39)

	Mean	Median	Standard Deviation	Min.	Max.
Average Group Performance	2.3	2.2	0.60	1.1	3.6
Aggregated Essay Score	3.6	3.6	0.84	2	5
Aggregated Post-Test %	62	63	8.38	47	76

Correlations among the performance variables are given in Table 4. The group performance measure correlates with both essay and test scores ($r = .52$, $p < .00$ and $r = .32$, $p = .04$ respectively). This result indicates that the group performance measure records similar aspects of performance to both essays and tests. The measure of essay performance and the measure for test performance are not correlated. Such a result implies that the indicators do not measure the same aspects of performance. One might conclude that the group performance measure taps aspects of academic performance as measured by both essays and tests, though those measures are exclusive of one another.

[1] The other two elements scored were Organization and Mechanics. As those two aspects of essay writing are more likely to be tied to skills than knowledge, I do not use them here.

Table 4: Correlations (with significance levels) among group and aggregated individual performance measures (N = 39)

	Group Performance	Essay Performance	Post-Test Percentage
Average Group Performance	1.0		
Aggregated Essay Performance	.52 (.00)	1.0	
Aggregated Post-Test Percentage	.32 (.04)	.26 (.11)	1.0

I began this investigation with the assumption that groups are "more than the sum of their parts." I was reminded that current thinking does not accept that a group is *more* than its parts, but sees a group as intrinsically *different* from the sum of its parts (McDermott, personal communication November, 2000). Taking a group as "more than its parts" assumes that a group can be described by the contributions of its members as individuals, plus some ineffable something whereby a given individual may transcend what she may have been able to accomplish if working alone; the mixture of individuals forms a whole without coherence. The idea that a group *differs* from the sum of its parts assumes that once formed, a group is a unique and coherent entity. Current thinking holds that comparisons between the two is a juxtaposition of unlike objects. Findings in this work support the latter conception of groups.

It can also be argued that creating a good product prepares group members for writing their essays and taking the test.[2] Test and essay performance follow the making of group products and their presentation in time. One would expect that activities *during* the course of the unit would contribute to students' performance on assessments *following* the unit. Indeed, Lotan asserts

[2] I am indebted to E. G. Cohen for her help with this point.

that engaging in discussions and manipulating activity materials that are closely tied to the unit content are an excellent preparation for academic writing (Lotan, personal communication, November 2000).

In the PCI study, essay tests were given after the other performance measures were collected. Rather than calling for recognition of the correct answer, as in multiple-choice tests, essay tests require students to recall information, analyze, compose, muster arguments, to name a few skills. Because of the timing of the essay test and the qualities of academic performance it measures, I use essay scores as the outcome variable in comparing group performance measures. That is, I regress essay scores aggregated to the group level on group performance scores and multiple-choice post-test scores aggregated to the group level, controlling for reading scores. Reading percentile is included because of its heuristic interest and robust predictive performance in other studies.

Table 5: Standardized coefficients for essay performance regressed on group performance and aggregated individual measures; Dependent variable: Essay content scores aggregated to the group level (N=39)

Predictors	Beta β	*t*	Probability Level [a]	Tolerance
Aggregated Post-test Percent	.08	0.52	.60	.87
Aggregated Reading Percentile	.15	1.03	.31	.95
Average Group Performance	.47	3.10	.00	.88
Model	Adj. R^2 = .24	F = 5.0	$p^a < .00$	

[a] p-values are reported as two-tailed tests

Table 5 shows that group performance predicts essay performance ($\beta = .47$, $p < .00$) while post-test performance does not ($\beta = .08$, $p = .60$). In past research, reading ability, as measured by standardized tests, has been a robust predictor of academic performance. In this case it is not. It is also worth noting that multiple-choice test performance is not a significant predictor of essay performance. While these results could be indicative of faulty measurement, the

magnitude of the different variables (beta weights) appears to indicate that group performance is a more proximate measure in predicting essay performance.

Tolerance statistics indicate that, as one might expect, little of the variance in reading scores is attributable to the variability in the other academic performance measures (tolerance = .95). About 10% of the variability in aggregated post-test scores and group performance is accounted for by other measures (tolerance = .87 and .88 respectively). Variables in this equation do not appear to depend on one another for their predictive capacity.

Discussion

Like the correlational findings, regression analysis indicates that group performance scores are a valid measure of academic performance at the group level. Group performance includes aspects of both essay performance (such as expressing one's own ideas) and multiple-choice test performance (for example, recognizing content). A teacher who assigns group grades on a group project can expect her students to protest that "It's not fair!" to assess them as groups rather than as individuals. Perhaps parents or administrators will echo that sentiment. These data show that the group measure is as "fair" a measure of academic performance as aggregating individual performance. Webb (1995) argues for the importance of matching group processes to the goals of the assessment. In this case, very close attention has been paid to maintaining the centrality of academic content to group processes and outcome measures.

Further, group performance shows predictive validity toward essay scores while aggregated multiple-choice test and standardized reading scores do not. The fact that two historically robust academic measures fail to reach significance could be interpreted as revealing problems with the academic measures. The close attention paid to specific historical content in the curriculum, group performance assessment, and tests argues against this interpretation. In my opinion, the more reasonable explanation is that repeated exposure to the

concepts in group performance activities is a more direct influence on students' ability to later recall and use those same concepts in an essay test.

I hold that the use of group performance, rather than aggregating individual performance scores to the group level, is a more proximate measure when assessing groups. Empirically, group performance is a better predictor of essay performance than is post-test score.

I find the results of this analysis to lend credence to the argument that a group transcends its constituent parts. I remain hesitant to use the term "more" in describing that transcendence. In academic settings, "more" must attach to improvements in academic performance. These analyses indicate that better group performance significantly improves performance on later individual academic achievement. Individual performance, aggregated to the group level, does not show the same result. These findings support my contention that group level performance measures are a better way to measure groups than aggregating individual measures to the group level.

The findings reported here also indicate that aggregating individual performance does work as a technique to measure group academic performance. While none of the outcome measures used could be said to capture all of academic performance, each of the measures tested reflects some aspects of that performance and can legitimately be used to measure academic outcomes.

Implications

This study confirms that group level analysis can be done successfully for conceptual academic content. While the difficulty of conducting academically-based group level analyses in school settings may have contributed to their being perceived as illegitimate in past, this study supports the idea that group level analyses can and should be done.

Establishing the measurability of group performance has methodological as well as practical implications. Sociological researchers outside schools routinely use aggregations of individual contributions as a measure of group

performance.[3] In those settings, a research and development team for example, the researcher does not use the group product as an outcome measure, though it may be of critical importance to the organization. Standards such as marketability are used as a sole judge of the group's performance rather than an assessment based on the characteristic qualities of the product the group was charged with creating (for example, cost, manufacturing, functionality, appeal, availability of raw materials, etc.). This work establishes the feasibility of using a true group product as a measure of a true group task in schools.

Another set of tools offered by this study are the rubrics for judging academic performance at the group level. These rubrics show practitioners how to maintain a content focus in assessing groups—and establish that it can be done successfully for conceptual academic content. The rubrics can act as models to the teacher for explicit statements about performance that are not a recipe-like reduction of the assignment.

When faced with group grades for group work, students everywhere cry "It's not fair!" As a teacher, I knew that group assessments could be as fair as any other type of assessment. Now I "know" that as a researcher, even using the word as advisedly as I now do. Educational researchers routinely aggregate individual scores to measure group performance. This study has shown that group scores can say as much as aggregated individual scores. While the researcher in me waits for the finding to be replicated, the teacher in me celebrates having an answer to a persistent and touchy question. I will celebrate even more when, and if, future work supports my intuition that a group is greater than the sum of its parts and that group measures can appropriately capture the contributions of all to what none could do alone.

Potentially productive research could grow out of this work in the area of the measurement of conceptual academic content at the group level.

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[3] I am indebted to B. Cohen for this point.

Parallel to the argument that a theory needs to be tested in a variety of contexts to gain legitimacy is the point that these instruments should be applied to a variety of subject matters to establish their usefulness outside the realm of history. Academic disciplines vary in their content and in the pedagogy used to communicate that content – compare the science class lab experiment to the English class analysis of a sonnet. My performance rubrics reflect the standards important in a history class. Further testing would reveal if the same technique holds utility in a foreign language or mathematics class.

My ability to measure academic performance at the group level does not mean that large numbers of teachers could do the same. Further work needs to be done to establish which aspects of this work hold the greatest utility for classroom teachers. In addition, one must also acknowledge the importance of preparing teachers understand and implement such measures in their own classrooms. Further, teachers may need support assessing conceptual content, as opposed to the more usual factual content. This study does not provide methods for putting these tools into the hands of classroom teachers.

Conclusion

Teaching is a complex endeavor. Teachers who take on added complexities, such as group activities or teaching conceptual content in addition to facts, need support. It is an unfortunate reality that academic content is not always central to the academic performances required of students or the assessments that they face. Tools for looking at interaction are necessary if we of the educational community want students to go beyond being individuals, seated alone at their desks. If we want students to have the opportunity to learn deep conceptual content, which we have often maintained is best done in groups, we must provide tools for teachers and students to use. Neither group assessment nor the study of concepts as well as facts have received sufficient development to make them institutions in education. This is a start.

Group Performance Scoring Sheet
The Afterlife in Ancient Egypt Activity 3: Tombs, Houses of Eternity

TRAG: _____ Date of Scoring: _____ Scorer: _____

Tape Number: _____ Begin Counter: _____ End Counter: _____ Duration: _____

	Concrete Content: Tomb				Broad Content: Design				Product Conventions: Looks			
Product	1	2	3	4	1	2	3	4	1	2	3	4

	Concrete Content: Type				Broad Content: Use				Presentation Conventions: Delivery			
Presentation	1	2	3	4	1	2	3	4	1	2	3	4

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Group Product Rubric

Activity Three –Tombs, Houses of Eternity

Concrete Content: **Tomb**	*Your group has been selected to design a tomb for the Pharaoh. Prepare a presentation to the Pharaoh that includes a recommendation for the type of tomb, a picture or 3-D model of what the tomb will look like on the inside, and an explanation of your choice. Present your design to the class.*
1	Depiction not clearly either monument or hidden type of tomb; does not include depiction of inside of tomb
2	Depiction discernibly monument or hidden type of tomb; does not include depiction of inside of tomb
3	Depiction discernibly monument or hidden tomb; includes depiction of inside of tomb; elements (such as tomb design and setting) not consistent with one another (e.g., tomb "hidden" under a pyramid)
4	Depiction clearly monument or hidden tomb; does includes depiction of inside of tomb; elements depicted combine to make a coherent whole
Broad Content: **Design**	
1	Depiction is not consistent with ancient Egyptian tomb design
2	Depiction is consistent with ancient Egyptian tomb design but does not address either space for, or protection of, tomb goods
3	Depiction is consistent with ancient Egyptian tomb design; tomb does address space for, and/or protection of, tomb goods
4	Depiction is consistent with ancient Egyptian tomb design and addresses both space for, and protection of, tomb goods; tomb protects occupant's goods in a manner consistent with ancient Egyptian tomb design

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Group Product Rubric

Activity Three –Tombs, Houses of Eternity

Presentation Conventions: **Looks**	1. Techniques well matched to chosen medium: a. Elements appropriate size (e.g., picture uses big paper, model big enough to see) b. Context given (e.g., pictured tomb has surroundings, model shows where tomb located) c. Constituent parts accented (e.g., different elements of tomb can be distinguished from one another) d. Techniques used support viewer's understanding message (e.g., uses of color apply in context, match between item and its representation) 2. Uses thoughtful/telling pictoral details (e.g., tomb may include mummy, sarcophagus, tomb paintings, etc.) 3. Elements of the depiction contribute to the clarity of the message (e.g., labeled fake doors or decoy hallways, spikes trap with impaled figure) 4. Depiction is a good example of what it is intended to be; more than a draft (e.g., drawing = good drawing, model = good model)
1	Uses four or fewer of the above conventions, success limited to technical conventions (a-d)
2	Uses at least four of the above conventions, exhibits at least one convention beyond technical elements (i.e., #s 2-4)
3	Uses at least five of the above conventions, exhibits at least two conventions beyond technical elements (i.e., #s 2-4)
4	Uses at least six of the above conventions, exhibits all three broad conventions (i.e., #s 2-4)

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Group Presentation Rubric

Activity Three –Tombs, Houses of Eternity

Concrete Content: **Type**	*Your group has been selected to design a tomb for the Pharaoh. Prepare a presentation to the Pharaoh that includes a recommendation for the type of tomb, a picture or 3-D model of what the tomb will look like on the inside, and an explanation of your choice. Present your design to the class.*
1	Chronological narrative of what actions the group took; speaker describes the depiction, though explanation of what was chosen and why are incomplete or inconsistent; does not give information about what the tomb looks like on the inside
2	Names type of tomb (monument/hidden); explains *what* choices were made, but explanation of *why* those choices were made is incomplete or inconsistent; tomb goods (if present) seen as "treasure," may address traps for tomb robbers.
3	Makes recommendation for type of tomb; clearly explains *what* choices were made as well as explains *why* these choices were made; tomb goods (if present) seen as useful to occupant in afterlife; may address traps for tomb robbers
4	Presentation made *to* Pharaoh explicitly includes recommendation for type of tomb; includes explanation of *why* that type of tomb was chosen; addresses occupant's need to *use* tomb goods; may address traps for tomb robbers

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Group Presentation Rubric

Activity Three –Tombs, Houses of Eternity

Broad Content: **Use**	
1	Type of tomb selected does not address ancient Egyptian beliefs about life or the afterlife. – We made a pyramid and we put all his things into it.
2	Reasons for proposed type of tomb based on issues for the living, does not make link to needs of the tomb's occupant or to ancient Egyptian beliefs about the afterlife; group's conception of tomb addresses the experience of the *living* – We decorated it with pictures – We built a pyramid so everybody will remember that he was Pharaoh – We made it hidden so robbers can't find it.
3	Gives reasons for proposed type of tomb that implicitly addresses ancient Egyptian beliefs about the afterlife; incorporates idea that occupant's afterlife connected to tomb; group's conception of tomb addresses protecting the experience of the dead – We built a pyramid so he could live there and be comfortable – We made a hidden tomb, so he can live happily ever after – We painted the walls with pictures of people doing things
4	Gives reasons for proposed type of tomb that explicitly address ancient Egyptian beliefs about the afterlife; incorporates idea that occupant needs to live in the tomb; group's conception of tomb addresses protecting the experience of the dead – We made a pyramid so the ba and ka can find the body – We made a hidden tomb, because if the robbers find it they'll take all his stuff and he won't be able to use it no more. – We put in couches and paintings and other things to make it nice.

Group Product Rubric

Activity Three –Tombs, Houses of Eternity

Presentation Conventions: **Delivery**	
1	Formulaic use of conventions of presentation; successfully uses three or fewer conventions; ordering of topics is simple chronology; teacher controls presentation
2	Mixed use of presentation conventions; at least four conventions used successfully; control of presentation split between teacher and group
3	Adequate use of presentation conventions; used five or more; control of presentation mostly handled by group
4	Fluent use of presentation conventions; order goes beyond chronology; group maintains control throughout presentation
	a. Presentation begins with introduction of topic (and group) **"I am happy to work with [name], [name], [name], and I am [name]."** *b. Presentation is loud enough to hear* *c. Presentation is rehearsed* *d. Full participation by group members* *e. Topics presented in orderly manner; transitions made between topics* *f. Transitions made between speakers* **"Now, here's [name]."**

Group Performance Scoring Sheet
The Afterlife in Ancient Egypt Activity 4: I Want My Mummy

TRAG : _____ Date of Scoring: _____ Scorer: _____

Tape Number: _____ Begin Counter: _____ End Counter: _____ Duration: _____
Song/dance/rap alone Song/dance/rap WITH presentation Presentation WITHOUT song/dance/rap .

	Concrete Content: How Mummify				Broad Content: Why Mummify				Product Conventions: Transmission			
Product	1	2	3	4	1	2	3	4	1	2	3	4
	Concrete Content: How II				Broad Content: Why II				Presentation Conventions: Delivery			
Presentation	1	2	3	4	1	2	3	4	1	2	3	4

Group Presentation Rubric
Activity Four — I Want My Mummy

Group performance has two elements, the product and the presentation. Three combinations of product and presentation are possible. For this activity, scoring differs based on the performance components used by the group.

If the performance has only a product (song, rap or dance):
score using How Mummify, Why Mummify, and Transmission as appropriate,
do not score How II, Why II, and Delivery.
Performance score = (How Mummify + Why Mummify + Transmission) x 2.

If the performance has only a presentation:
give each How Mummify, Why Mummify, and Transmission a score of 1 (lowest possible),
score How II, Why II, and Delivery as appropriate.
Performance score = How II + Why II + Delivery + 3

If the performance has both product and presentation:
score How Mummify, Why Mummify, and Transmission as appropriate,
score How II, Why II, and Delivery as appropriate.
Performance score = How Mummify + Why Mummify + Transmission + How II + Why II + Delivery

Note that scores given for the presentation must **equal or exceed** the scores given for the product. Though the presentation score will at least equal the product score, doing both presentation and product does not guarantee a higher score than doing the product alone.

Group Presentation Rubric
Activity Four — I Want My Mummy

Concrete Content: **How Mummify**	As a group, create a song, rap, or dance in which you describe the mummification of an ancient pharaoh. Include details about the steps in preparing the body for burial.
1	Song, rap, or dance does not describe mummification process, uses 2 or fewer major elements; does not give details — "The Pharaoh is dead ǀ He died in his bed ǀ Before he could wed ǀ Because of what he was fed" — mummy, mummy, mummify, oh yeah baby…
2	Song, rap, or dance includes 3 or more major elements, gives few or incorrect details — you remove the organs and put them in the sarcophagus — and you take out the guts, and then you put on the salt…
3	Song, rap, or dance addresses 4 or more major elements with inconsistent detail support; may explain purpose and use of amulets — you take out the heart and put it away for later — and you use amulets
4	Song, rap, or dance explains 5 or more major elements giving details of each step; explains purpose and use of amulets — you remove the heart and liver through a slit in the side and put them into canopic jars — you remove the brain through the nose, they didn't care if they messed up 'cause it was the heart that mattered — amulets are there to protect him from evil spirits on his way to the heart ceremony
	Major elements in burying a pharaoh: 1) remove organs, 2) dry body using natron, 3) wrap body in linen, 4) protect with amulets, 5) identify body (usu. mask or painting), 6) entomb pharaoh

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Group Presentation Rubric
Activity Four — I Want My Mummy

Broad Content: **Why Mummify**	
1	Song, rap, or dance lists elements of mummification; does not include/address spiritual aspect at all — First you… then you…
2	Song, rap, or dance states or implies that mummification is tied to afterlife; not specific — You wrap him up 'cause then he'll need it
3	Song, rap, or dance mentions specific spiritual aspect of ancient Egyptian afterlife (Ba & Ka, gods, weighing heart); link made but no details given — My mummy and my Ba, Oooh Baby.
4	Song, rap, or dance makes link between mummification and specific spiritual element (Ba & Ka, gods); conveys idea of causality (for example, 'this practice gets you into the afterlife" or "if you don't do this your afterlife will be unpleasant") — The Ba gives comfort to the family and wife

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Group Presentation Rubric
Activity Four — I Want My Mummy

Presentation Conventions: **Transmission**	a. Delivery technique: audible, rehearsed, etc. b. Form of words: uses rhyme, assonance, alliteration, etc. c. Delivery of words: uses rhythm, dynamic volume, etc. d. Form of whole: tells story with beginning, middle, & end; has chorus, etc. e. Content of words: captures ideas using words that are catchy, telling, parsimonious, etc. f. Delivery sophistication: different parts going simultaneously, lead and background, voice modification, movement, etc. A "true performance." Rate each of the above conventions as "poor job/not done" (0), "okay" (1), or "good job" (2).
1	Totals 3 or fewer points
2	Totals 4 or more points; at least 2 conventions
3	Totals 6 or more points; at least 3 conventions
4	Totals 8 or more points; all 5 conventions

Group Presentation Rubric
Activity Four — I Want My Mummy

Concrete Content: **How II**	As a group, create a song, rap, or dance in which you describe the mummification of an ancient pharaoh. Include details about the steps in preparing the body for burial.
1	Presentation IN CONJUNCTION WITH song, rap, or dance does not describe mummification process, uses 2 or fewer major elements; does not give details — We were gonna say that you pulled out his organs
2	Presentation IN CONJUNCTION WITH song, rap, or dance includes 3 or more major elements, gives few or incorrect details — then they would remove the organs and put them in the sarcophagus
3	Presentation IN CONJUNCTION WITH song, rap, or dance addresses 4 or more major elements with inconsistent detail support; may explain purpose and use of amulets — they would take out the heart and put it away for later — we were going to tell how they would use amulets
4	Presentation IN CONJUNCTION WITH song, rap, or dance explains 5 or more major elements giving details of each step; explains purpose and use of amulets — they would remove the heart and liver through a slit in the side and put them into canopic jars — after they removed the brain through the nose, they didn't care if they messed up 'cause it was the heart that mattered. That's kind of cool.

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Group Presentation Rubric
Activity Four — I Want My Mummy

Broad Content: **Why II**	
1	Presentation IN CONJUNCTION WITH song, rap, or dance shows no understanding of the ancient Egyptian concept of the afterlife; does not mention modern beliefs. — we were going to say that they always mummified the king.
2	Presentation IN CONJUNCTION WITH song, rap, or dance shows limited conceptual grasp of ancient Egyptian beliefs about the afterlife; does not tie Egyptian practices to beliefs today. — They need to be mummified for the afterlife.
3	Presentation IN CONJUNCTION WITH song, rap, or dance shows conceptual grasp of ancient Egyptian beliefs about the afterlife; may tie Egyptian practices to beliefs today but does not give details. — Our song said that they would be mummified so they could use their body in the afterlife.
4	Presentation IN CONJUNCTION WITH song, rap, or dance shows conceptual grasp of ancient Egyptian beliefs about the afterlife created/maintained the practice of mummification; if ties Egyptian practices to beliefs today, gives specific details. — The Ba had to recognize the body so it could go to the family each day and they wanted to be able to stay with their family, that's why they painted the face. — We don't mummify like that. I mean, you don't need your body when you're an angel.

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Group Presentation Rubric
Activity Four — I Want My Mummy

Presentation Conventions: **Delivery**	
1	Formulaic use of conventions of presentation; successfully uses three or fewer conventions; ordering of topics is simple chronology; teacher controls presentation
2	Mixed use of presentation conventions; at least four conventions used successfully; control of presentation split between teacher and group
3	Adequate use of presentation conventions; used five or more; control of presentation mostly handled by group
4	Fluent use of presentation conventions; order goes beyond chronology; group maintains control throughout presentation
	a. Presentation begins with introduction of topic (and group) **"I am happy to work with [name], [name], [name], and I am [name]."** b. Presentation (not including song, rap, or dance) is loud enough to hear c. Presentation (not including song, rap, or dance) is rehearsed d. Full participation by group members e. Topics presented in orderly manner; transitions made between topics f. Transitions made between speakers **"Now, here's [name]."** g. Clear separation between delivery of song, rap, or dance and the remainder of the presentation.

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The Importance of the Afterlife in Ancient Egypt
Activity 3: Tombs - Houses of Eternity

The Ancient Egyptians believed that tombs served as homes in the afterlife. Egyptians built two types of tombs for their kings. A tomb was either part of a large and obvious structure like the pyramids, or it was hidden away in a hard to find place. All of the possessions that were necessary in the afterlife were stored in the tomb. It was very important that the deceased and his possessions be kept safe in the tomb for all eternity.

As a group, read the resource card, examine the pictures, and discuss the following questions:

1. Using the Group Information Organizer, discuss and record the advantages and disadvantages of pyramid versus hidden tombs.

2. Priests and builders of the secret chambers in tombs occasionally stole the treasures. What moral conflicts might a priest or a builder face if he knew the location of hidden treasures?

3. What are some of the most important things to consider in building a tomb that would ensure a happy afterlife?

Group Task

Your group has been selected to design a tomb for the Pharaoh. Prepare a presentation for the Pharaoh that includes a recommendation for the type of tomb, a picture or 3-D model of what the tomb will look like on the inside, and an explanation of your choice. Present your design to the class.

Evaluation Criteria
- Presentation is convincing.
- Presentation gives good reasons for the type of tomb chosen.
- Picture shows that your tomb solves problems that ancient builders worried about.

The Importance of the Afterlife in Ancient Egypt
Activity 3: Tombs-Houses of Eternity

Individual Report

Pretend you are an Ancient Pharaoh. Illustrate your idea of a perfect tomb. Explain how it would ensure a happy afterlife.

Evaluation Criteria
- Answer make clear what type of tomb you, as Pharaoh, prefer.
- You, as Pharaoh, make at least three points in support of your choice.

The Importance of the Afterlife in Ancient Egypt
Activity 4: I Want My Mummy

The ancient Egyptians had one great wish: to live forever. The Egyptians' belief in life after death led to their complex mummification process. The Egyptians believed that each soul had two parts: the Ba and the Ka. Both the Ba and the Ka were released from the body at the time of death. The Ba lived with the family during the day and returned to the body at night. The Ka traveled from the body to the other world. In order for the Ba and the Ka to return to the body at night, the body had to be recognizable. After death, the bodies of pharaohs and nobles were mummified to preserve them. Bodies of ordinary people were preserved by placing them in the hot, dry sand of the desert. The ancient Egyptians believed they would live in their tombs just as they had lived on earth.

As a group, read the resource card, look at the pictures, and discuss the following questions.

1. How does the practice of mummification tie in with the ancient Egyptians beliefs in the Ba and Ka?

2. Describe the mummification process. Why was each step of the process so important?

3. How might some of the amulets pictured on your resource card help the deceased on his journey to the afterlife?

4. Can you see any purpose for preserving the dead in our time? Explain why or why not.

Group Task

As a group, create a song, rap, or dance in which you describe the mummification of an ancient pharaoh. Include details about the steps in preparing the body for burial.

Evaluation Criteria
- Performance is easy for the class to follow and understand.
- Song, rap, or dance gives details about the materials and amulets used.
- Beliefs about Ba and Ka are part of the presentation.

The Importance of the Afterlife in Ancient Egypt
Activity 4: I Want My Mummy

Individual Report

The Egyptians tucked magical amulets in with mummies to protect them in their travels to the afterlife. Create a personal amulet that is important to you. Explain why it will be important for you in the afterlife.

Evaluation Criteria
- Answer gives at least three reasons amulet will contribute to a happy afterlife.
- Answer shows connection between the purpose of the amulet and its magical powers.

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